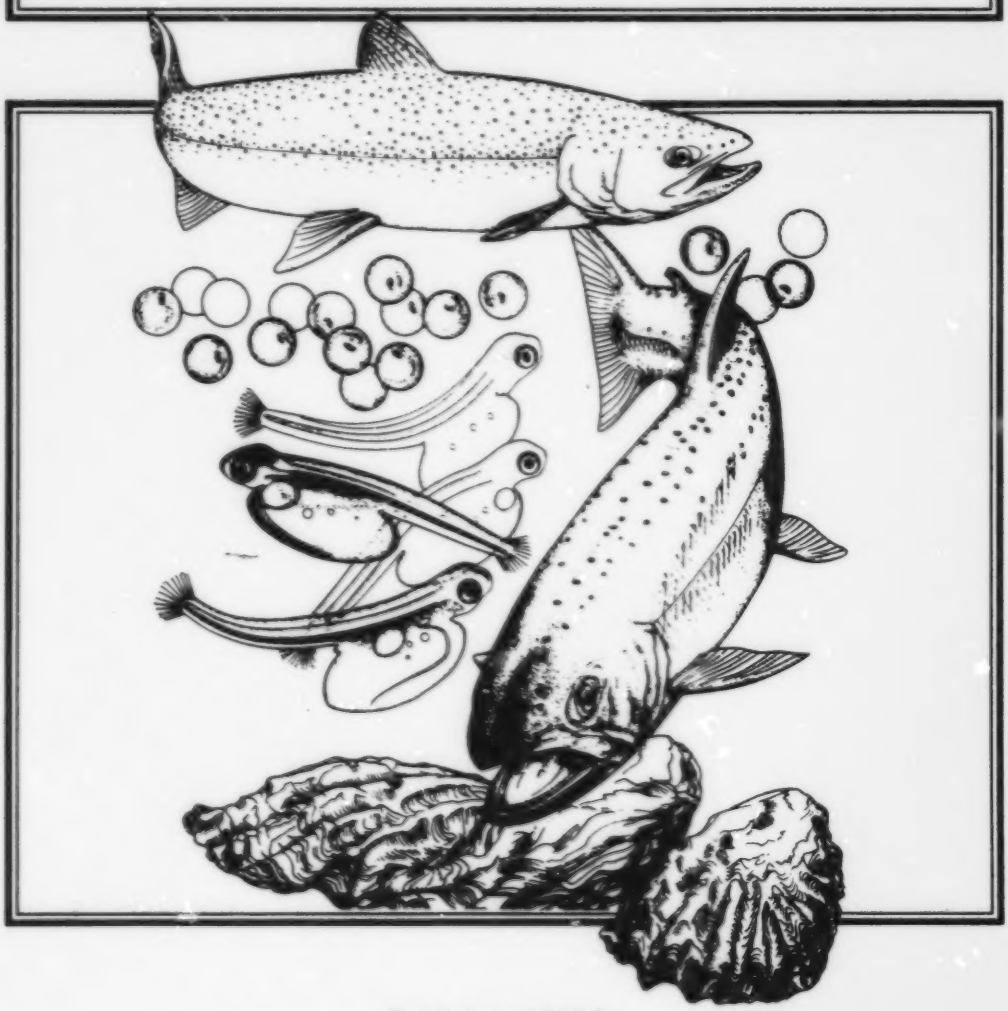
Aquaculture Industry Development Report

Estimated Costs and Returns for Rainbow Trout Production in the Thompson-Okanagan Region 1990



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S.J. Hopkinson P.M. Gubbels

Abstract

This study describes a rainbow trout, ***Oncorhynchus mykiss*** grow-out facility which operates as adjunct to an existing "traditional" agriculture farm located in the Thompson-Okanagan region. The trout enterprise requires a water supply of at least 910 liters per minute (200 gallons per minute). and has an ongoing annual production of approximately 30,000 (8,877 kg round weight) rainbow trout for the local market. The farmer receives $1.70 and $3.40 per pound round weight for trout sold directly to the processor and for on-farm retail sales, respectively. The trout farm developed in this study is hypothetical and represents a "best estimate" scenario only. The study is intended to provide the farmer with an example for calculating costs and returns of producing trout, and serve as a trout farm business analysis and planning reference.

Two scenarios are described: Scenario A uses a pumped water source whereas Scenario B is supplied by an artesian well. The artesian facility has significantly lower capital, operating, and opportunity costs, which result in a 29% higher net farm income and a 128% higher return to operator labour and management than in Scenario A. The impact of alternative prices for both scenarios is described. A $0.10 per pound difference in price causes the net farm income to be increased or decreased by $1,958.

In addition to water supply and alternative prices, factors such as stock survival and feed conversion can have dramatic impact on net farm income. Feed costs represent up to 41% and 44% of the cash operating costs in Scenario A and B, respectively.

Introduction

Objective

This study was prepared in response to a need expressed by existing and potential trout producers and investors, for an estimate of the cost of production for rainbow trout. It is intended to provide the farmer with an example for calculating the costs and returns of producing trout as a supplementary enterprise on an existing agricultural farm. Additionally, the study should serve as a trout farm business analysis and planning reference, particularly in the Thompson-Okanagan Region.

Data Sources and Methodology

The assumptions and data used in this study were provided by trout producers, agribusiness supply and service firms, provincial Ministry of Agriculture and Fisheries staff, and miscellaneous references.

A preliminary study of cost and returns was presented to trout producers from the Thompson-Okanagan Region during a March, 1990 meeting in Little Fort, British Columbia. The study was then distributed to several of the meeting participants for further comment and recommendations. Appropriate suggestions were incorporated into this copy.

The study describes a rainbow trout grow-out facility which utilizes earthen ponds and operates as adjunct to an existing "traditional" agriculture farm. The trout farm developed in this study is hypothetical and represents a "best estimate" scenario only. The estimated costs and returns associated with this "best estimate" scenario can be used as a basis for developing alternative scenarios where one or more factors are altered. For example, the study describes a second scenario, which was developed from the results of the first.

Study Use

This study is not intended as a trout production manual, but rather as a farm management reference for comparative analysis and for budgeting purposes. It is important to realize that the data used in the study is estimated and based on the assumption that the facility is well managed by an experienced fish culturist.

Costs and prices will change over time, and appropriate adjustments to the cost and price figures in this study will be required to ensure the information is current.

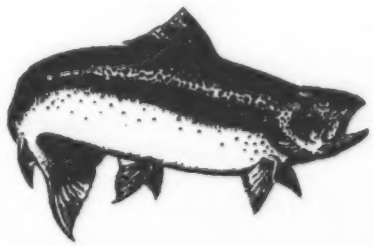
The study data was based on specific assumptions, therefore, the information can not be used directly. Appropriate interpretation and modification is required where conditions other than specified exist. Each farm is unique, in terms of the biophysical characteristics of the site (for example variances in temperature will directly influence growth rate of the trout), location, fish husbandry and management expertise, investment costs, and production and marketing practices. Therefore, it should be expected that farms will differ considerably in quantity and quality of trout production, and the costs and returns for production. Based on the above considerations, the interpretation and proper use of this study can be a fairly complex process.

Study Organization

The study analysis type and scope; the consensus farm and its physical and biological profile; the fish analysis groups, fish numbers and growth rates are described within the General Background Information and Assumptions section.

The study considers two scenarios: Scenario A describes a trout farm using a pumped water source, and Scenario B describes the same farm supplied by an artesian well that allows gravity-flow through the system. Scenario A was developed and is presented first . The Summary of Capital Investment (Exhibit 1) and Annual Costs and Returns (Exhibit 2) are followed by sections providing the assumptions and calculations that were used to derive them. Scenario B was developed from Scenario A and is described by Exhibit 3 and Exhibit 4. The Analysis section focuses on the results and interpretation of the study.

To ensure compete understanding of study content and to avoid misinterpretation, the study should be approached in the sequence in which it is presented.



General Background Information and Assumptions

The farm:

The trout enterprise is a small venture which serves to supplement the income of a "traditional" agricultural farm operation located in the Thompson/Okanagan region. The trout enterprise requires 1 acre of the total farm area and has an on-going annual production of approximately 30,000 (8,877 kg, round weight) rainbow trout for the local market.

Analysis type and scope:

The study is an economic analysis providing annual costs and returns, as of February 1990, for the on-going production of 8 to 10 ounce dressed trout.

Biophysical characteristics of farm site:

water:

- source: ground water pumped from a 10 metre depth
- volume: minimum flow of 909 litres (200 gallons) per minute
- temperature (Degrees celsius): May (9.5), June to August (15), Sept. (13.4), Oct. (13.0), Nov. (8.3), Dec. (7.0), Jan. and Feb. (6.0), Mar. (5.0) April (7.0)
- quality: high, no sources of harmful water pollution
- oxygen: 95% saturation following the aeration tower.

soil: high clay content, optimal for operation of an earthen pond

slope: gentle to enable gravity flow through rearing and settling ponds

predators: dragon fly larvae, giant water bugs, birds and mammals

site access: by road, farm residence located nearby

services: electric power is provided to the farm. The service community (i.e. equipment, repair services, and supplies), is located within 40 km of the farm.

Description of Fish Stock:

The stock is domestic rainbow trout, ***Oncorhynchus mykiss*** purchased as 5-gram (3 inch) fingerlings from a disease-free hatchery located in British Columbia.

Stock survival to market:

A total of 33,000 fingerlings are ponded each year. The loss rate throughout the production cycle is assumed to be 10.5% from all causes, which results in 29,543 trout marketed each year.

Pond system:

The pond system consists of 1 head pond, 3 rearing ponds and 1 settling pond. The water storage capacity of the head pond is 27.2 cubic metres, the three rearing ponds have a capacity of 350 cubic metres (77,000 gallons) each, and the settling pond, 243 cubic metres (53,500 gallons). The sides of the pond have a 1 to 1.5 slope.

General management practices:

In practise, fingerlings purchase should be staggered to ensure that an inventory of different-sized fish is maintained and the water supply is used most efficiently. To simplify the analysis and best illustrate the costs and returns associated with trout production the study assumes that fingerlings are ponded on May 1st each year and raised to an average live weight of 300 grams (10.6 ounces) over a production cycle ranging from 12.5 months to 17.5 months.

Trout are regularly graded from April to October of the second year; fish of market size are separated and held for harvest. When approximately 450 kg (1000 lbs) of fish reach marketable weight, they are harvested.

Netting is secured on a frame over the ponds for predator control. The fish are fed regularly and according to feed manufacturer's recommendations. Stocking densities do not exceed 12 kg per cubic metre.

The facility is well managed by an experienced fish culturist and all measures are taken to minimize stress to the trout stock. It is anticipated that the farm will produce up to 10 kg of live trout per year for each litre of water per minute. Actual loading densities at any point in time will likely not exceed 1/3 this level. New, inexperienced farmers would not be expected to achieve this level of production.

Analysis groups:

As growth rates may vary considerably, the analysis groups are based on three scenarios; fast, average and slow growth. The starting number of fish and time of harvest for each group is as follows:

Growth Group	Start Number	Harvest Number	Harvest Period	Average Harvest Point*
fast	5,742	5,161	April 15 to June 15	May 15 (12.5 months)
average	21,516	19,262	June 15 to August 15	July 15 (15.5 months)
slow	5,742	5,120	August 15 to October 15	Sept. 15 (17.5 months)
Total	**33,000**	**29,543**		

* Indicated on Tables 1, 2, and 3 (Appendix A)

Number of fish for each analysis group:

The starting number of fish; fish losses due to preharvest mortality caused by disease, stress, or predation; and total number of fish sold are given in the following table for each growth group.

Group	Start Number	Total Loss	% Loss	Total Sales	% Sales
Fast growth	5,742	581	10.1	5,161	89.9
Average growth	21,516	2,254	10.5	19,262	89.5
Slow growth	5,742	622	10.8	5,120	89.2

Detailed data for the number of trout in each growth group is provided in Appendix A, Tables 1, 2, and 3.

Weight of fish for each analysis group:

The total harvested weight from each analysis group is shown in the following table.

Group	Total Start Weight (kg)	Average Harvest Weight (kg) per Fish	Harvested Weight (kg)
Fast growth	28.7	0.3005	1,551
Average growth	107.6	0.3005	5,788
Slow growth	28.7	0.3005	1,538
Total			**8,877**

Detailed data for the weight of trout in each growth group is provided in Appendix B, Tables 4, 5, and 6.

Scenario A: Pumped Water Source

1. Estimated Capital Investment

Exhibit 1: Summary of Estimated Capital Investment for a Trout Production Enterprise Using a Pumped Water Source

Item		Replacement Cost* $	Years of Use	Salvage Value* $	Annual Deprec.* $	Annual Interest* $	Ref. Page*
1	Land	2,000				240	4
2	Well	5,570	20	3,070	125	518	4
3	Pump and motor	5,980	7.5	3,987	266	598	5
4	Surface aerators	1,200	7.5	800	53	120	5
5	Generator (20%)**	3,000	10	2,000	100	300	5
6	Nets	1,698	5	424	255	127	5
7	Water system	2,763	30	0	92	166	5
8	Ponds	3,100	40	2,325	19	326	6
9	Fence	560	30	0	19	34	6
10	Building (25%)**	2,000	40	200	45	132	6
11	Electric service	1,000	40	100	23	66	6
12	Truck (10 %)**	2,000	10	400	160	144	6
13	Miscellan. (20%)**	1,000	5	0	200	60	6
14	Trout stock	30,913				927	6
Totals		**62,784**		**13,306**	**1,357**	**3,758**	

***Notes:**

Replacement Cost = typical new cost.

Salvage Value = trade-in or remaining value when the item must be replaced or rebuilt.

Annual Depreciation = (replacement cost minus salvage value) divided by years in use.

Annual Interest for:

Item 1 = replacement cost times opportunity cost interest rate; Items 2 to 13 = (replacement cost plus salvage value) divided by 2 times the opportunity cost interest rate. It is assumed that on average the items are at the mid-point of their life and capital value; item 14 = see ref. page for calculations. The opportunity cost interest rate = the Feb. 1990, 1 year Canada Treasury Bill rate of 12%.

Ref. Page = the page on which details for the item can be found.

** These items are used jointly for the whole farm. The costs shown represent the % allocated to the trout enterprise.

Capital Investment Assumptions and Calculations

1. Land:

The replacement cost of land can vary considerably. It is estimated that 1 acre of cleared land, suitable for the trout farm, and as part of an existing 40-acre farm, would have a replacement cost of about $2,000.

2. Well:

The well produces a continuous water flow not less than 909 litres (200 gallons) per minute. The well is 10 metres (33 feet) deep. The estimated replacement cost

is calculated as follows:

Mobilization	$ 1,000
Drill - $ 40.00 per foot x 33 ft.	$ 1,320
Shoe	$ 250
Screens - 2 x $ 750. each	$ 1,500
Develop - bail & run clean	$ 500
Demobilization	$ 1,000
	$5,570

3. Pump and motor:

The pump and motor (5.0 HP submersible pump and motor) operates continuously throughout the year and has an efficiency range of 75 to 80% with an operating output of 910 litres (200 gallons) per minute. Estimated replacement cost, including low pressure shut off switch, warning alarm, 120 feet of wiring, 10 metre (33 feet) 10 centimetre (4 inch) drop pipe and fabricated well head is $3,130.

Pump, motor unit etc.	$ 3,130
Installation	$ 2,850
	$5,980

4. Aerators:

Two surface aerators are available for use in the event of low oxygen levels and for temporary back-up in the event of pump failure. Each aerator, has a 1/3 horsepower electric motor and a pump capable of moving about 900 litres (200 gallons) per minute. The estimated replacement cost for each aerator is $ 600.

2 aerators x $ 600 **$1,200**

5. Generator:

A 30-kilowatt diesel generator is available for emergency situations to service the whole farm in the event of electric power failure. The generator has an estimated replacement cost of $15,000 and 20% of its use is allocated to the trout enterprise.

$15,000 x 0.20 **$3,000**

6. Nets:

a/ Seine nets:

The seine net is 2.5 centimetre (1 inch) stretched knotless mesh, 16 metres (52.5 feet) long and 1.5 metres (4.9 feet) deep complete with 25 pieces of cork along the top and leadline 3 kilograms per metre (2 pounds per foot) along the bottom. The estimated replacement cost for one net is $550.

2 seine nets x $550.00 **$1,100**

b/ Predator nets:

Predator nets are used on two of the three rearing ponds. The nets are made of black nylon with a stretched mesh size of 15.2 centimetres (6 inch). A frame is used to suspend the predator nets 2 metres above the ponds. Therefore, the predator nets require a 2 metre overhang around the entire perimeter of the pond. Since the pond dimensions are 24.5 metres long by 6 metres wide, the dimensions of each net are 28.5 metres long by 10 metres wide. Thus, the number of square metres for each net is 285 (i.e. 28.5 x 10). Rope with a 1.3 centimetre (.5 inch) diameter, is attached to the perimeter of each net to facilitate securing and handling. The cost calculation for the predator nets is as follows:

285 sq. m per net x 2 nets x $.49 per sq. m	$ 280
88 metres of rope x $ .89 per metre	$ 78
Total	$ 355

c/ Holding-pen nets:

The holding pens have a 1.8 x 1.2 x 0.6 metres (6 x 4 x 2 ft) frame made of PVC pipe or lumber which is covered with 2.5 centimetre (1 in)-mesh net.

Estimated replacement cost of 1 holding pen is $ 121.50

2 holding pens x $ 121.50 **$ 243**

Total net replacement cost
(sum of a, b and c) is **$1,698**

7. Water system:

a/ Aeration tower:

An aeration tower set on a concrete base, with dimensions 1.5 metres (5 feet) high, 1.2 metres (4 feet) wide and 1.2 metres (4 feet) long, could be constructed on site. Estimated replacement cost is calculated as follows:

lumber, concrete, hardware and screens	$ 300
labour (20 hours @ $8.00/hour)	$ 160
	$ 460

b/ PVC pipe (non-pressure) and fittings:

Pump to header pond	
3 m (9.8 feet) of 20.3 cm (4 inch) pipe	
@ $7.15 per m ($2.18 per foot)	$ 21
Header pond to rearing ponds	
12 m (39.4 feet) of 10.2 cm (4 inch) pipe	
@ $7.15 per m ($2.18 per foot)	$ 86
Rearing ponds to settling pond	
12 m (39.4 feet) of 15.2 cm (6 inch) pipe	
@ $8.30 per m ($2.53 per foot)	$100
Valves and joints	
2- 10.2 cm (4 inch) ball valves x $280	$ 560
2- 15.2 cm (6 inch) ball valves x $300	$ 600
8 - 90 degree elbows (4 inch) x $14.50	$ 116
2 - tees (6 inch) x $73	$ 146
6 - cut-off collars x $ 15	$ 90
Total	**$1,719**

c/ Trenching and installation of pipes:
24 m (79 feet) x $6.56 per m ($2.00 per foot) **$ 157**

d/ Excavation of .6 m (2 feet) deep water discharge ditches:
50 m (164 feet) x $8.53 per m ($2.60 per foot) **$ 427**

e/ Total cost for the water system (sum of a to d) is **$ 2,763**

8. Ponds:

a/ Head pond:
The head pond is 4 m (13 feet) x 4 m (13 feet) x 1.7 m (5.5 feet) deep.
The estimated replacement cost is **$ 200**

b/ Rearing ponds:
There are 3 rearing ponds with the dimensions of 24.5 metres (80 feet) long, 6 metres (20 feet) wide, and .8 m (2.5 ft) deep at head end sloping to 1.5 m (5 ft) at outlet end. Estimated replacement cost for each pond is $750.
3 ponds x $ 750 **$2,250**

c/ Settling pond:
The dimensions of the settling pond are 30 m (98.4 feet) long, 9 m (29.5 feet) wide and .9 m (3 feet) deep. Estimated replacement cost is $650.
1 pond x $ 650 **$ 650**

d/ The total cost for the ponds (sum of a, b and c) is **$3,100**

9. Fence:

A 255 metre (835 foot) five strand barbed wire fence surrounds the trout production facility. The fence replacement cost, based on cost for materials, labour, and machine use, is equivalent to $2.20 per metre ($ .67 per foot).
255 metres x $ 2.20 per metre **$ 560**

10. Building:

An existing building is used to store feed and equipment. The estimated replacement cost is $8000, of which 25% is allocated to the trout enterprise.
$ 8,000 x 0.25 **$2,000**

11. Electric service:

The trout operation requires a 91 metre (300 foot) power line extension to the site. The estimated replacement cost, including poles, wire, insulators and installation is **$1,000**

12. Truck:

The pickup truck is $20,000 with 10% of its use allocated to the trout enterprise.
$ 20,000 x .10 **$2,000**

13. Miscellaneous equipment:

Miscellaneous equipment, which includes demand feeders, tools, scales, deep freeze, etc. has a replacement cost of $ 5,000 where 20 % of the cost is allocated to the trout enterprise.
$ 5,000 x .20 **$1,000**

14. Trout stock:

The total replacement cost for the trout stock (before beginning a year of full production) is equal to the costs of establishing the trout, which is calculated as the sum of the following (refer to values given in Exhibit 1 and Exhibit 2):

Cash Operating Costs less hired labour costs	$22,349
Hired and operator labour (excl. harvesting labour) at $8.00 per hour	$ 2,832
Depreciation	$ 1,357
Interest on Operating Capital	$ 1,544
Interest on Capital Investment (less interest on trout stock)	$ 2,831
Replacement Cost is	**$30,913**

This amount is recovered by selling the trout over a 6 month period, April 15 to Oct. 15, with the midpoint at 3 months. Therefore, the annual interest cost is calculated based on 3 months (or 0.25 years) interest at 12% on the trout replacement cost.
$30,913 x 0.12 x 0.25 **$927**

2. Estimated Annual Costs and Returns

Exhibit 2: Summary of Estimated Annual Costs and Returns for a Trout Production Enterprise Using a Pumped Water Source

	Item Description	Total $	Per lb Trout (Round)* $	Per Trout* $	% of Oper. Costs & Depr.*	Ref. Page*
	Return					
	Sales to processor	31,615	1.70	1.13		
	On-farm sales	3,328	3.40	2.25		
1	**Total Return**	**34,943**	**1.79**	**1.18**	**129.0**	**8**
	Cash operating costs:					
2	Feed	11,024	0.56	0.37	40.7	8
3	Fingerlings	5,775	0.30	0.20	21.3	8
4	Fingerling and feed transport	1,647	0.08	0.06	6.1	8
5	Electric power	1,938	0.10	0.07	7.2	9
6	Repair and maintenance	510	0.03	0.02	1.9	9
7	Hired labour	3,392	0.17	0.11	12.5	9
8	Miscellaneous	1,455	0.07	0.05	5.4	10
9	**Total Cash Operating Costs**	**25,741**	**1.31**	**0.87**	**95.0**	**10**
10	Depreciation	1,357	0.07	0.05	5.0	10
11	**Total Cash Operating Costs and Deprec.**	27,098	1.38	0.92	100.0	10
12	**Net Farm Income**	**7,845**	**0.40**	**0.27**		**10**
13	Less interest on capital investment	3,758	0.19	0.13		10
14	Less interest on operating capital	1,544	0.08	0.05		10
15	**Return to Operator Labour and Management**	**2,543**	**0.13**	**0.09**		**10**

***Notes**

Per lb of Trout (Round) = "Total $" divided by 19,576 pounds live weight of trout sold.

Per Trout $ = Total $ divided by 29,543 trout sold.

% Oper. Costs and Depr. = Total $ divided by Total Cash Operating Costs and Depreciation ($27,098) multiplied by 100.

Ref. page = the page on which details for the item can be found.

Annual Costs and Returns Assumptions and Calculations

1. Total Return:

Fish are harvested regularly from April 15 through to October 15. The maximum for each harvest is 450 kg (1,000 lbs). Ninety-five percent of the harvest is sold on-site to the processor who then transports the fish live to the processing facility. Five percent of the harvest is processed and sold on-site directly to the consumer.

The farmer receives payment from the processor, based on the round weight of the trout harvested at time of transfer to the processing facility. The dress-out yield factor is anticipated to average 0.85.

All fingerlings are stocked in May and reared to an average of 300.5 grams (10.6 ounces) within a production cycle extending from 12.5 to 17.5 months.

	Processor	On-Farm	Total
Number of fish marketed	28,066	1,477	29,543*
Average live weight (grams)	300.5	300.5	-
Total live weight (kg.)	8,433.8	443.8	8,877.6
Total live weight (pounds)	18,597.0	979.0	19,575.0
Price per pound	$1.70	$3.40	**
Return from sales	$31,615	$3,328	$34,943

* 95% sold to processor and 5% to on-farm sales
** The weighted average sale price is $1.79 per round pound.

2. Feed:

Type	Months Fed	Cost per kg ($)
#4 crumbles	2	0.94
grower	6 to 8	0.76
grower*	5 to 7	0.86

* with 50 parts per million pigment.

3. Fingerlings:

The cost per 5 gram rainbow trout fingerling, when purchased in lots of 20,000 to 50,000, is $0.175.
33,000 x $ 0.175 $ 5,775

A summary of the total amount of feed used and the total feed cost is provided below. Total feed amounts and costs were calculated from Tables 7, 8, and 9 which are given in Appendix C.

Group	Source of data	Total Feed (kg)	Total Feed Cost ($)
Fast growth	Table 7	2,020	1,645
Average growth	Table 8	8,705	7,202
Slow growth	Table 9	2,610	2,177
Total		**13,335**	**11,024**

4. Fingerling and feed transport:

a/ Fingerling delivery: charges are based on the truck size required to transport fingerlings and the mileage one-way.
Pick-up truck ($ 0.90 per km x 200 km) $ 180

b/ Feed delivery: is anticipated to add an additional $0.11 per kg. to feed costs. Therefore, as total feed required is 13,335 kg, delivery costs are expected to be $1,467. $ 1,467

Total delivery costs (sum of a/ and b/) **$1,647**

5. Electric power:

The B.C. Hydro rate schedule (February 1990) is 6.42 cents per kilowatt hour (kW.h) for the first 550 kW.h and 4.60 cents per kW.h for all additional kW.h. The 4.60 cents was used in calculating farm equipment operating costs as the first 550 kW.h is generally used in the farm residence. Calculation of the electric power costs is based on the formula: $ per kW.h x the kW used by the electric motor per hour x # of hours operation.

The trout farm requires electric service for a 5.0 HP pump, two aerators, a building and freezer. Annual electric power costs are calculated as follows:

4.49 kW pump for 365 days:	
$.046 x 4.49 kW x 8760 hours	$ 1,809.29
0.25 kW aerator for 105 days:	
$.046 x 0.25 kW x 2520 hours	$ 28.98
Building and freezer :	
expected maximum cost	$ 100.00
Total annual electric power cost	**$1,938.27**

6. Repair and Maintenance:

Item	Replacement Cost *	Annual Repair & Maintenance %	Annual Repair & Maintenance Cost ** $
well	5,570	0	0.00
pump & motor	5,980	1.0	59.80
aerators	1,200	1.0	12.00
generator (20%)	3,000	1.0	30.00
nets	1,698	1.0	16.98
water system	2,763	1.0	27.63
ponds	3,100	2.5	77.50
fence	560	1.0	5.60
building (25%)	2,000	1.0	20.00
electric service	1,000	1.0	10.00
truck (10%)	2,000	10.0	200.00
miscellaneous equipment (20%)	1,000	5.0	50.00
Total			**509.51**

* Source: see Summary of Capital Investments (Exhibit 1.)
** Replacement Cost multiplied by %Repair & Maintenance/100

7. Labour:

Activity	Period	Hired Labour (hours)	Operator Labour (hours)	Total (hours)
Prepare ponds & stock	May	-	4	4
Feed etc. (.5 h per day x 365 days)	full year	130	52	182
Net repair & maint. (8 h per month)	full year	96	-	96
Monitor & record (4 h. per month)	full year	48	-	48
Grade & transfer (8 h. x 20 harvests)	Apr.-Oct.	80	80	160
On-farm sales (.25 h. per 6 fish)	Apr.-Oct.	46	16	62
Clean ponds	June-Sept.	24	-	24
Total Hours		**424**	**152**	**576**

Hired labour cost per hour including benefits, is assumed to be $8.00 per hour. The total annual cost for hired labour is:

424 hours x $8.00 per hour	$3,392.00

It is anticipated that the operator will commit an additional 25% of his time to the management of the trout facility. Therefore, total hours spent by the operator is:

operator labour hours	152
operator management hours (152 x .25)	38
Total operator hours	**190**

8. Miscellaneous:

	Cost for entire farm $	Allocation to trout enterprise %	Cost to trout enterprise $
Aquaculture licence	100	100	100
Vet. services & medication	286	100	286
Property taxes	1,000	2.5	25
Truck insurance	610	10	61
Fuel (gas & diesel)	2,200	10	220
General insurance	600	25	150
Telephone	650	25	163
Accounting	400	25	100
Bus. expenses meetings etc.	1,000	25	250
Others including supplies, mags etc.	400	25	100
TOTAL			**$1,455**

9. Total Cash Operating Costs:

The sum of items 2 (fingerlings) to 8 (miscellaneous)

10. Depreciation:

See Total Annual Depreciation provided in Exhibit 1, Summary of Capital Investment

11. Total Cash Operating Costs plus Depreciation:

The sum of total cash operating costs and depreciation

12. Net Farm Income:

The net farm income is calculated by subtracting the total cash operating costs and depreciation from the total return (item 1 minus item 11). The net farm income is the residual return to operator labour, management, and investment.

13. Interest on Capital Investment:

See Summary of Capital Investment, Exhibit 1.

14. Interest on Operating Capital:

It is assumed that payments made for items 2 to 8 are spread fairly evenly over the full year. Thus, for the purposes of calculating interest, the average amount invested in operating costs during the year is one-half the total amount. The opportunity cost interest on operating capital can be calculated by multiplying the sum of the operating costs by one-half and by a 12% opportunity cost interest rate. i.e.

[$5,775 + $1,647 + (11,024 + $1,938 + $510 + $3,392 + $1,455) x .5] x .12 = $1,544

15. Return to Operator Labour and Management:

This is a residual return to operator labour and management obtained by subtracting the interest on capital investment (item 13) and on operating capital (item 14) from the net farm income (item 12). It is anticipated that the operator will devote a total of 190 hours per year to the operation of the trout facility (see item 7). On this basis, the $2,543 return to operator labour and management represents a return of $13.38 per hour. i.e. $2,543 divided by 190 hours.

Scenario B: Artesian Water Supply

1. Estimated Capital Investment

Exhibit 3: Summary of Estimated Capital Investment for a Trout Production Enterprise Using a Gravity Water Supply

Item		Replacement Cost* $	Years of Use $	Salvage Value* $	Annual Deprec.* $	Annual Interest*	Ref. Page*
1	Land	2,000				240	4
2	Well	5,570	20	3070	125	518	4
3	Pump and motor	0	0	0	0	0	11
4	Surface aerators	1,200	7.5	800	53	120	5
5	Generator (5%)**	750	10	500	25	75	11
6	Nets	1,698	5	424	255	127	5
7	Water system	2,763	30	0	92	166	5
8	Ponds	3,100	40	2,325	19	326	6
9	Fence	560	30	0	19	34	6
10	Building (25%)**	2,000	40	200	45	132	6
11	Electric service	1,000	40	100	23	66	6
12	Truck (10%)**	2,000	10	400	160	144	6
13	Miscellan. (20%)**	1,000	5	0	200	60	6
14	Trout stock	27,744				832	11
Totals		**51,385**		**7,819**	**1,016**	**2,840**	

***Notes:**

Replacement Cost = typical new cost.
Salvage Value = trade-in or remaining value when the item must be replaced or rebuilt.
Annual Depreciation = (replacement cost minus salvage value) divided by years in use.
Annual Interest for: item 1 = replacement cost times opportunity cost interest rate; items 2 to 13 = (replacement cost plus salvage value) divided by 2 times the opportunity cost interest rate. It is assumed that on average the items are at the mid-point of their life and capital value; item 14 - see the calculation on the following page. The opportunity cost interest rate = the Feb. 1990, 1 year Canada Treasury Bill rate of 12%.
Ref. Page = the page on which details of the item can be found.
** These items are used jointly for the whole farm. The costs shown represent the % allocated to the trout enterprise.

Capital Investment Assumptions and Calculations

The capital investment assumptions and calculations are as stated in Scenario A, with the following exceptions:

Item 3: Pump and Motor:

The water source in Scenario B is assumed to be from an aquifer which does not require additional pumping. Therefore, capital investment and interest costs associated with the pump and motor have been omitted.

Item 5: Generator:

As there is no pump and motor in Scenario B , there is less reliance on the generator for emergency power. Therefore, only 5% of the replacement cost for the generator is allocated to the trout enterprise rather than 20% as in Scenario A.

$15,000 x 0.05 $750.

Item 14: Trout Stock (3 month interest):

The total replacement cost for the trout stock (before beginning a year of full production) is equal to the cost of establishing the trout, which is calculated as the sum of the following (refer to values given in Exhibit 3 and Exhibit 4):

Cash Operating Costs less	hired labour costs	$20,457
Hired and operator labour	(excl. harvesting labour) at $8.00 per hour	$ 2,832
Depreciation		$ 1,016
Interest on Operating Capital		$ 1,431
Interest on Capital Investment	(less interest on trout stock)	$ 2,008
Replacement Cost is		**$27,744**

This amount is recovered by selling the trout over a 6 month period, April 15 to Oct. 15, with the midpoint at 3 months. Therefore, the annual interest cost is calculated based on 3 months (or 0.25 years) interest at 12% on the trout replacement cost. $27,744 x 0.12 x 0.25 = $832

2. Estimated Annual Costs and Returns

Exhibit 4: Summary of Estimated Annual Costs and Returns for a Trout Production Enterprise Using an Artesian Water Supply

	Item Description	Total $	Per lb Trout (Round)* $	Per Trout* $	% of Op. Costs & Deprec. %	Ref. Page*
	Return					
	Sales to processor	31,615	1.70	1.13		
	On-farm sales	3,328	3.40	2.25		
1	**Total Return**	**34,943**	**1.79**	**1.18**	**140.5**	**8**
	Cash operating costs:					
2	Feed	11,024	0.56	0.37	44.3	8
3	Fingerlings	5,775	0.30	0.20	23.2	8
4	Fingerling and feed transport	1,647	0.08	0.06	6.6	8
5	Electric power	129	0.01	0.00	0.5	13
6	Repair and maint.	427	0.02	0.01	1.9	9, 13
7	Hired labour	3,392	0.17	0.11	13.6	9
8	Miscellaneous	1,455	0.07	0.05	5.9	10
9	**Total Cash Operating Costs**	**23,849**	**1.22**	**0.81**	**95.9**	**10**
10	Depreciation	1,016	0.05	0.03	4.1	10, 13
11	**Total Cash Operating Costs and Deprec.**	**24,865**	**1.27**	**0.84**	**100.0**	**10**
12	**Net Farm Income**	**10,078**	**0.51**	**0.36**		**10**
13	Less interest on capital investment	2,840	0.15	0.10		10, 13
14	Less interest on operating capital	1,431	0.07	0.05		10, 13
15	**Return to Operator Labour and Management**	**5,807**	**0.30**	**0.20**		10, 13

***Notes**

Per lb of Trout (Round) $ = "Total $" divided by 19,576 pounds live weight of trout sold.
Per Trout $ = Total $ divided by 29,543 trout sold.
% of Op. Costs and Deprec. = Total $ divided by Total Cash Operating Costs and Depreciation ($24,865) multiplied by 100.
Ref. page = the page on which details of the item can be found.

Annual Costs and Returns Assumptions and Calculations

The annual costs and returns assumptions and calculations are as stated in Scenario A except for the changes associated with the operation of a pump and motor. Items that have reduced costs as a consequence of not pumping water are as follows:

Item 5: Electric Power:

The annual power costs associated with pumping water in Scenario A (i.e. $1,809) are not included in Scenario B. It is anticipated that the annual electric power cost for the operation of the aerators, building, and freezer will be $129

Item 6: Repair and Maintenance:

Reduced by $83 to $427.

Item 10: Depreciation:

Reduced by $341 to $1,016.

Item 13: Interest on Capital Investment:

Reduced by $918 to $2,840.

Item 14: Interest on Operating Capital:

Reduced by $113 to $1431.

Item 15: Return to Operator Labour and Management:

Increased by $3,264 to $5,807. This represents a return per hour of $30.56.

Analysis

1. Comparison of Scenario A and B

A summary of total estimated annual costs and returns for a supplementary trout grow-out enterprise is given below for the two alternative scenarios described above.

	Item Description	Scenario B: Artesian Water Supply $	Scenario A: Pumped Water Supply $	Difference : Scenario B Minus Scenario A
	Return			
	Sales to processor	31,615	31,615	0
	On-farm sales	3,328	3,328	0
1	**Total Return**	**34,943**	**34,943**	**0**
	Cash operating costs:			
2	Feed	11,024	11,024	0
3	Fingerlings	5,775	5,775	0
4	Fingerling and feed transport	1,647	1,647	0
5	Electric power	129	1,938	-1,809
6	Repair and maintenance	427	510	-83
7	Hired labour	3,392	3,392	0
8	Miscellaneous	1,455	1,455	0
9	**Total Cash Operating Costs**	**23,849**	**25,741**	**-1,892**
10	Depreciation	1,016	1,357	-341
11	**Total Cash Operating Costs and Deprec.**	**24,865**	**27,098**	**-2,233**
12	**Net Farm Income**	**10,078**	**7,845**	**+2,233**
13	Less interest on capital investment	2,840	3,758	-918
14	Less interest on operating capital	1,431	1,544	-113
15	**Return to Operator Labour and Management**	**5,807**	**2,543**	**+3,264**

From the above comparison of Scenario A and B, it is clear that a trout production facility with an artesian water supply has a distinct advantage over one with a pumped water supply. The artesian facility has lower capital, operating and opportunity costs which result in a higher net farm income and return to operator labour and management. In other words, costs for water pumping can greatly reduce the margin between trout production costs and returns.

2. Alternative Prices

Since markets and marketing processes are dynamic, the prices received for trout could be considerably lower or higher than the **weighted average price of $1.79** per pound live weight shown in this study. In order to illustrate the impact of alternative prices for Scenario A and Scenario B described above, the following table is presented:

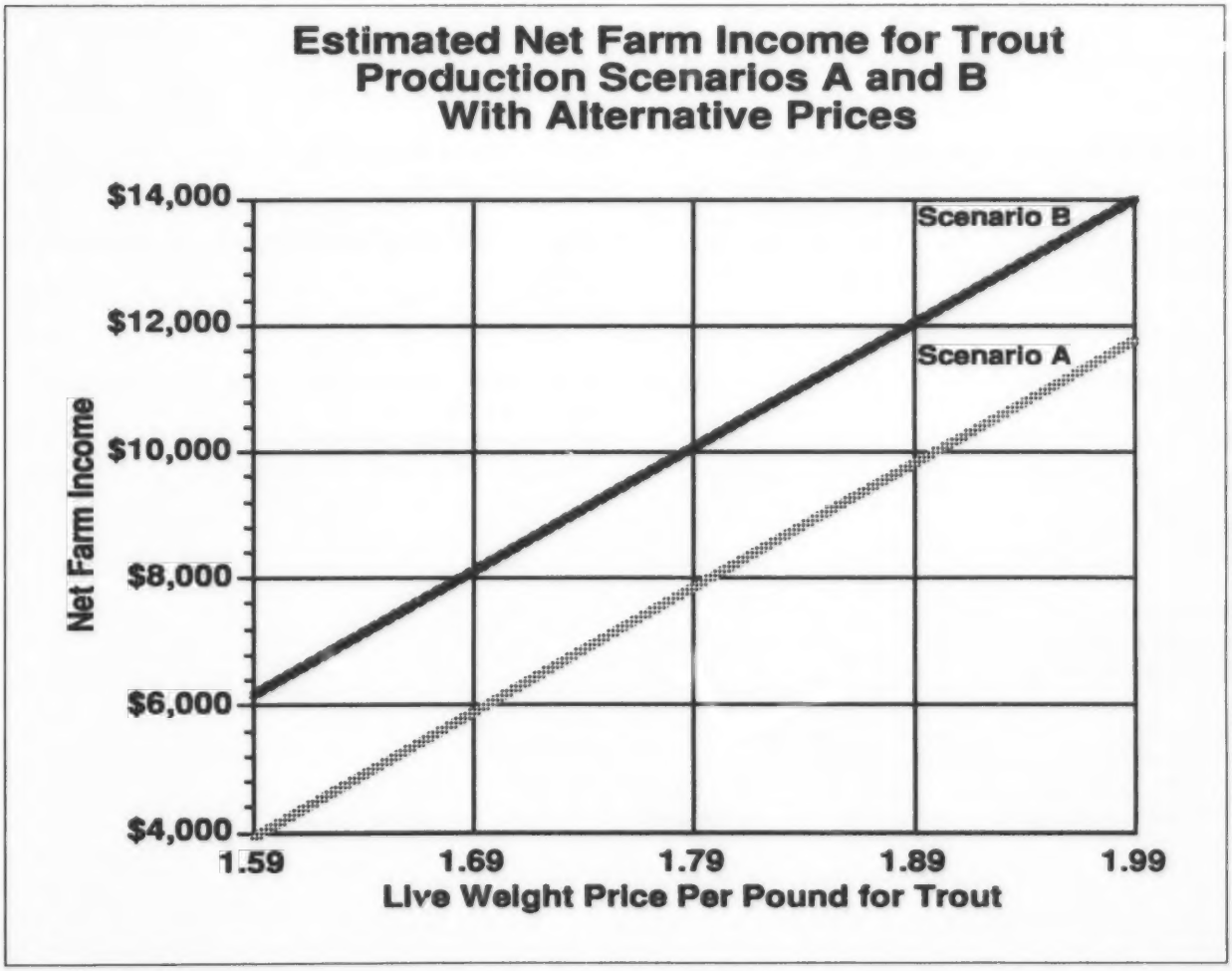
Estimated Net Farm Income for Alternative Trout Prices:

	Weighted Average Prices of Trout* $ per Pound Live Weight				
	$1.59	$1.69	$1.79	$1.89	$1.99
Scenario A	3,930	5,888	7,845	9,803	11,761
Scenario B	6,163	8,121	10,078	12,036	13,994

*The weighted average prices are derived by obtaining the sum of the sales value for the 95% of trout sold to processors and the 5% of trout sold on farm and dividing it by the total number of pounds live weight trout sold.

For both Scenario A, pumped water supply, and Scenario B, artesian water supply, each $.10 per pound difference in price results in a difference of $1,958 in net farm income.

The above table can be illustrated graphically as follows:



3. Other Factors

In addition to water supply and alternative prices, as shown in points 1 and 2 above, there are a number of other factors, including stock survival and feed conversion efficiency, that can have a dramatic impact on net farm income. Perhaps the most important other factor is trout survival. The results obtained in this study are based on assumptions that the trout production is managed by an experienced fish culturist and that fish survival to market is 89.5%. Any reduction in numbers of fish surviving to market would impact directly by lowering the net farm income.

Since feed is the most important cash operating cost, any reduction in feed efficiency can also lower the expected net farm income.

This study is based on the assumption that the trout operation is a supplementary enterprise on an existing farm and that the investment costs for some capital items are shared. If the trout farm were the sole enterprise, the fixed costs of depreciation and interest on investment could be considerably higher than reported in this study.

4. A Selected List of Analysis Ratios

Although the ratios given below do not necessarily represent ideal standards, they may serve as examples of measures that could be helpful for rainbow trout farm business analysis and planning.

Trout surviving to market as a percent of fingerlings placed:

29,543 / 33,000 x 100	**89.5%**

Replacement cost of capital items (excluding fish stocks) per kilogram live weight of trout marketed:

Scenario A

$ 31,871 / 8,877 kg	**$ 3.59**
($ 31,871 / 19,750 lb)	**($ 1.61)**

Scenario B

$ 23,641 / 8,877 kg	**$ 2.66**
($ 23,641 / 19,750 lb)	**($ 1.20)**

Well, ponds and water system investment per kilogram live weight of trout marketed:

$ 11,433 / 8,877 kg	**$ 1.29**
($ 11,433 / 19,750 lb)	**($ 0.58)**

Cost of feed per kilogram live weight of trout marketed:

$ 11,024 / 8,877 kg	**$ 1.24**
($ 11,024 / 19,750 lb)	**($ 0.56)**

Cost of fingerlings per kilogram live weight of trout marketed:

$ 5,775 / 8,877 kg	**$ 0.65**
($ 5,775 / 19,750 lb)	**($ 0.29)**

Cost of hired labour per kilogram live weight of trout marketed:

$ 3,392 / 8,877 kg	**$ 0.38**
($ 3,392 / 19,750 lb)	**($ 0.17)**

Cash operating costs and depreciation per kilogram live weight of trout marketed:

Scenario A

$ 27,098 / 8,877 kg	**$ 3.05**
($ 27,098 / 19,750 lb)	**($ 1.37)**

Scenario B

$ 24,865 / 8,877 kg	**$ 2.80**
($ 24,865 / 19,750 lb)	**($ 1.26)**

Weighted average cost of feed per kilogram of feed fed:

$11,024 / 13,335 kg	**$ 0.83**
$11,024 / 29,398 lb	**($ 0.38)**

Kilograms of feed fed per kilogram live weight of trout marketed:

13,335 kg / 8,877 kg	**1.50**
(29,398 lb / 19,750 lb)	**1.50**

Kilograms live weight of trout marketed per litre per minute of water flow:

8,877 kg / 909 litres per minute	**9.76**
(19,750 lb / 200 gallons per minute)	**(98.75)**

Appendices

Appendix A

Tables 1,2 and 3 show the total numbers of fish for each growth group scenario; fast, slow and average fish growth. The values given in the Tables were calculated as follows:

Column 2: Start #
1 May - the specified starting number.
2 June and subsequent months to the final sales month = column 7, End# for the previous month.

Column 3: Loss %
Estimated loss rate for each month.

Column 4: Loss #
Start # multiplied by Loss % and divided by 100.

Column 5: Sales %
The specified average harvest point.

Column 6: Sales #
For a given month, Start # minus Loss# multiplied by sales % and divided by 100.

Column 7: End#
Start # minus Loss # plus Sales #.

Column 8: Average #
Start # plus End# and divided by 2.

Table: 1 Number of: Trout - Fast Growth Group

1 Month	2 Start #	3 Loss %	4 Loss #	5 Sales %	6 Sales #	7 End #	8 Average #
Apr			0		0	0	0
1 May	5,742	2.0%	115		0	5,627	5,685
2 June	5,627	1.5%	84		0	5,543	5,585
3 July	5,543	1.5%	83		0	5,460	5,501
4 Aug.	5,460	1.0%	55		0	5,405	5,432
5 Sept.	5,405	1.0%	54		0	5,351	5,378
6 Oct.	5,351	1.0%	54		0	5,297	5,324
7 Nov.	5,297	0.5%	26		0	5,271	5,284
8 Dec.	5,271	0.5%	26		0	5,245	5,258
9 Jan	5,245	0.5%	26		0	5,218	5,232
10 Feb.	5,218	0.3%	16		0	5,203	5,211
11 Mar.	5,203	0.3%	16		0	5,187	5,195
12 Apr.	5,187	0.3%	16		0	5,172	5,179
13 May	5,172	0.2%	10	100.0%	5,161	0	2,586
14 June							
15 July							
TOTAL			581		5,161		

581	(Total Loss) +	5,161	(Total Sales) =	5,742 Total
581	(Total Loss) /	5,742	(Start) =	10.11% Loss
5,161	(Total Sales) /	5,742	(Start) =	89.89% Sales

Table: 2 Number of: Trout - Average Growth Group

1 Month	2 Start #	3 Loss %	4 Loss #	5 Sales %	6 Sales #	7 End #	8 Average #
Apr			0		0	0	0
1 May	21,516	2.0%	430		0	21,086	21,301
2 June	21,086	1.5%	316		0	20,769	20,928
3 July	20,769	1.5%	312		0	20,458	20,614
4 Aug.	20,458	1.0%	205		0	20,253	20,356
5 Sept.	20,253	1.0%	203		0	20,051	20,152
6 Oct.	20,051	1.0%	201		0	19,850	19,950
7 Nov.	19,850	0.5%	99		0	19,751	19,801
8 Dec.	19,751	0.5%	99		0	19,652	19,702
9 Jan	19,652	0.5%	98		0	19,554	19,603
10 Feb.	19,554	0.3%	59		0	19,495	19,525
11 Mar.	19,495	0.3%	58		0	19,437	19,466
12 Apr.	19,437	0.3%	58		0	19,379	19,408
13 May	19,379	0.2%	39		0	19,340	19,359
14 June	19,340	0.2%	39		0	19,301	19,320
15 July	19,301	0.2%	39	100.0%	19,262	0	9,651
16 Aug.							
17 Sept.							
TOTAL			2,254		19,262		

2,254	(Total Loss) +	19,262	(Total Sales) =	21,516	Total
2,254	(Total Loss) /	21,516	(Start) =	10.47%	Loss
19,262	(Total Sales) /	21,516	(Start) =	89.53%	Sales

Table: 3 Number of: Trout - Slow Growth Group

1 Month	2 Start #	3 Loss %	4 Loss #	5 Sales %	6 Sales #	7 End #	8 Average #
Apr			0		0	0	0
1 May	5,742	2.0%	115		0	5,627	5,685
2 June	5,627	1.5%	84		0	5,543	5,585
3 July	5,543	1.5%	83		0	5,460	5,501
4 Aug.	5,460	1.0%	55		0	5,405	5,432
5 Sept.	5,405	1.0%	54		0	5,351	5,378
6 Oct.	5,351	1.0%	54		0	5,297	5,324
7 Nov.	5,297	0.5%	26		0	5,271	5,284
8 Dec.	5,271	0.5%	26		0	5,245	5,258
9 Jan	5,245	0.5%	26		0	5,218	5,232
10 Feb.	5,218	0.3%	16		0	5,203	5,211
11 Mar.	5,203	0.3%	16		0	5,187	5,195
12 Apr.	5,187	0.3%	16		0	5,172	5,179
13 May	5,172	0.2%	10		0	5,161	5,166
14 June	5,161	0.2%	10		0	5,151	5,156
15 July	5,151	0.2%	10		0	5,141	5,146
16 Aug.	5,141	0.2%	10		0	5,130	5,135
17 Sept.	5,130	0.2%	10	100.0%	5,120	0	2,565
18 Oct.							
19 Nov.							
TOTAL			622		5,120		

622	(Total Loss) +	5,120	(Total Sales) =	5,742	Total
622	(Total Loss) /	5,742	(Start) =	10.83%	Loss
5,120	(Total Sales) /	5,742	(Start) =	89.17%	Sales

Appendix B

Tables 4, 5 and 6, show the weigh. of fish for each growth scenario; fast, slow and average fish growth. The values given in the Tables were calculated as follows:

Column 2: Average Start (kg)
1 May - the average weight at the start is a specified number.
2 June and subsequent months to the final sales month = Average start (kg) for the previous month plus column 4, Average Gain for the previous month.

Column 3: Gain %
Specified gain rate derived from a growth model (Iwama et. al. 1990) for rainbow trout in conjunction with specified water temperatures (see biophysical characteristics of site - water temperature).

Column 4: Average Gain (kg)
Average Start (kg) multiplied by Gain % and divided by 100.

Column 5: End#
Transferred from End # column on "Number of Fish" tables (refer to Table 1,2 and 3).

Column 6: Accumulated Fish Weight (kg)
End # (refer to Table 1,2 and 3) multiplied by Average Start (kg) for the following month.

Table: 4

Weight of: Trout - Fast Growth Group

1 Month	2 Average Start (kg)	3 Gain %	4 Average Gain (kg)	5 End #	6 Accumulated Fish Wt. (kg)
Apr			0.000	0	0
1 May	0.005	100.0%	0.005	5,627	56
2 June	0.010	95.0%	0.010	5,543	108
3 July	0.020	78.0%	0.015	5,460	190
4 Aug.	0.035	65.0%	0.023	5,405	310
5 Sept.	0.057	50.0%	0.029	5,351	460
6 Oct.	0.086	36.0%	0.031	5,297	619
7 Nov.	0.117	22.0%	0.026	5,271	751
8 Dec.	0.143	15.0%	0.021	5,245	860
9 Jan	0.164	9.5%	0.016	5,218	937
10 Feb.	0.179	10.0%	0.018	5,203	1,027
11 Mar.	0.197	15.0%	0.030	5,187	1,178
12 Apr.	0.227	20.5%	0.047	5,172	1,415
13 May	0.274	19.5%	0.053	0	0
14 June	0.327		0.000	0	0

Table: 5

Weight of: Trout - Average Growth Group

1 Month	2 Average Start (kg)	3 Gain %	4 Average Gain (kg)	5 End #	6 Accumulated Fish Wt. (kg)
Apr			0.000	0	0
1 May	0.005	100.0%	0.005	21,086	211
2 June	0.010	90.0%	0.009	20,769	395
3 July	0.019	62.0%	0.012	20,458	630
4 Aug.	0.031	52.0%	0.016	20,253	948
5 Sept.	0.047	38.0%	0.018	20,051	1,295
6 Oct.	0.065	26.0%	0.017	19,850	1,615
7 Nov.	0.081	15.0%	0.012	19,751	1,848
8 Dec.	0.094	12.0%	0.011	19,652	2,059
9 Jan	0.105	9.0%	0.009	19,554	2,233
10 Feb.	0.114	9.5%	0.011	19,495	2,438
11 Mar.	0.125	16.0%	0.020	19,437	2,820
12 Apr.	0.145	24.0%	0.035	19,379	3,486
13 May	0.180	24.0%	0.043	19,340	4,314
14 June	0.223	22.0%	0.049	19,301	5,252
15 July	0.272	21.0%	0.057	0	0
16 Aug.	0.329		0.000	0	0

Table: 6

Weight of: Trout - Slow Growth Group

1	2	3	4	5	6
Month	Average Start (kg)	Gain %	Average Gain (kg)	End #	Accumulated Fish Wt. (kg)
Apr			0.000	0	0
1 May	0.005	85.0%	0.004	5,627	52
2 June	0.009	65.0%	0.006	5,543	85
3 July	0.015	50.0%	0.008	5,460	125
4 Aug.	0.023	45.0%	0.010	5,405	179
5 Sept.	0.033	35.0%	0.012	5,351	240
6 Oct.	0.045	28.0%	0.013	5,297	304
7 Nov.	0.057	24.0%	0.014	5,271	375
8 Dec.	0.071	15.0%	0.011	5,245	429
9 Jan	0.082	9.0%	0.007	5,218	465
10 Feb.	0.089	9.5%	0.008	5,203	508
11 Mar.	0.098	15.0%	0.015	5,187	582
12 Apr.	0.112	22.0%	0.025	5,172	708
13 May	0.137	22.0%	0.030	5,161	862
14 June	0.167	20.0%	0.033	5,151	1,033
15 July	0.201	18.0%	0.036	5,141	1,216
16 Aug.	0.237	17.5%	0.041	5,130	1,426
17 Sept.	0.278	16.0%	0.044	0	0
18 Oct.	0.323		0.000	0	0

Appendix C

Tables 7, 8 and 9 show the feed consumption and cost for each growth group scenario; fast, slow and average fish growth. The values given in the Tables were calculated as follows:

Column 2: Total Gain (kg)
Average # (column 8 of Tables 1, 2 and 3) multiplied by Average Gain (kg) (column 4 of Tables 4, 5 and 6)

Column 3: Feed Utilization
Estimated data as indicated by study participants

Column 4: Total Feed (kg)
Total Gain (kg) multiplied by Feed Utilization

Column 5: Feed Cost per kg ($)
Data suggested by feed manufacturer

Column 6: Total Feed Cost
Total Feed (kg) multiplied by Feed Cost per kg

Table: 7

Feed Required for: Trout - Fast Growth Group

1 Month	2 Total Gain (kg)	3 Feed Utilization	4 Total Feed (kg)	5 Feed Cost per kg ($)	6 Total Feed Cost ($)
Apr	0		0		0.00
1 May	28	1.10	31	0.94	29.39
2 June	53	1.20	64	0.94	59.85
3 July	84	1.30	109	0.76	82.67
4 Aug.	123	1.30	159	0.76	121.09
5 Sept.	154	1.30	200	0.76	152.15
6 Oct.	165	1.30	214	0.76	162.68
7 Nov.	136	1.30	177	0.76	134.19
8 Dec.	112	1.30	146	0.76	111.07
9 Jan	81	1.30	106	0.86	91.08
10 Feb.	94	1.30	122	0.86	104.56
11 Mar.	154	1.30	200	0.86	172.01
12 Apr.	241	1.30	313	0.86	269.53
13 May	138	1.30	179	0.86	154.24
14 June					
TOTAL	**1,562**		**2,020**		**1,644.50**

Total Feed (kg)/	Total Weight Gain (kg)	= kg feed per kg of fish live weight gain
2,020	1,562	**1.29**

Table: 8

Feed Required for: Trout - Average Growth Group

1 Month	2 Total Gain (kg)	3 Feed Utilization	4 Total Feed (kg)	5 Feed Cost per kg ($)	6 Total Feed Cost ($)
Apr	0		0		0.00
1 May	107	1.40	149	0.94	140.16
2 June	188	1.45	273	0.94	256.72
3 July	243	1.50	364	0.76	276.82
4 Aug.	326	1.50	489	0.76	371.42
5 Sept.	358	1.50	537	0.76	408.43
6 Oct.	335	1.50	502	0.76	381.79
7 Nov.	242	1.50	362	0.76	275.45
8 Dec.	221	1.50	332	0.76	252.14
9 Jan	185	1.50	277	0.76	210.74
10 Feb.	212	1.50	318	0.76	241.50
11 Mar.	390	1.50	584	0.86	502.47
12 Apr.	676	1.50	1,014	0.86	871.67
13 May	836	1.50	1,254	0.86	1,078.16
14 June	948	1.50	1,422	0.86	1,223.06
15 July	552	1.50	827	0.86	711.44
16 Aug.					
TOTAL	**5,817**		**8,705**		**7,201.97**

Total Feed (kg)/	Total Weight Gain (kg)	= kg feed per kg of fish live weight gain
8,705	5,817	1.50

Table: 9

Feed Required for: Trout - Slow Growth Group

1 Month	2 Total Gain (kg)	3 Feed Utilization	4 Total Feed (kg)	5 Feed Cost per kg ($)	6 Total Feed Cost ($)
Apr	0		0		0.00
1 May	24	1.45	35	0.94	32.93
2 June	34	1.60	54	0.94	50.50
3 July	42	1.70	71	0.76	54.24
4 Aug.	56	1.70	95	0.76	72.31
5 Sept.	62	1.70	106	0.76	80.73
6 Oct.	67	1.70	114	0.76	86.32
7 Nov.	73	1.70	124	0.76	93.99
8 Dec.	56	1.70	95	0.76	72.48
9 Jan	39	1.70	65	0.76	49.76
10 Feb.	44	1.70	75	0.76	57.02
11 Mar.	76	1.70	129	0.86	111.23
12 Apr.	128	1.70	217	0.86	187.04
13 May	156	1.70	265	0.86	227.62
14 June	172	1.70	293	0.86	251.94
15 July	186	1.70	316	0.86	271.55
16 Aug.	213	1.70	362	0.86	310.91
17 Sept.	114	1.70	194	0.86	166.84
18 Oct.					
TOTAL	1,541		2,610		2,177.40

Total Feed (kg)/	Total Weight Gain (kg)	= kg feed per kg of fish live weight gain
2,610	1,541	1.69